

Appl. No. : 10/829,638
Filed : April 22, 2004

AMENDMENTS TO THE CLAIMS

As indicated below, Applicant is amending Claims 1, 4, 6, 7, 10, 14, 16, 17, 19, 23, 28, 30, 31, and is cancelling Claims 8 and 18 without prejudice or disclaimer. Claims 2, 3, 5, 9, 11–13, 15, 20–22, 24–27, 29 and 32–38 remain as originally filed or as previously presented.

1. (Currently Amended) An apparatus comprising:

at least one wafer-processing chamber wherein an ozone-rich environment exists within the wafer-processing chamber;

a rotator that creates a gap between a wafer and a wafer cassette, wherein the rotator is configured to rotate the wafer;

a sprayer; and

a pulsating fluid liquid source, the pulsating fluid liquid source configured to pulse a liquid solution through the sprayer into the ozone-rich environment while the wafer is rotating, the pulsating liquid source having a duty cycle that varies between 3% and 97%.

2. (Original) The apparatus of Claim 1, wherein the wafer cassette remains stationary while the wafer is rotating.

3. (Original) The apparatus of Claim 1, wherein the rotator rotates the wafer at a velocity of less than 100 rotations per minute (RPM).

4. (Currently Amended) The apparatus of Claim 1, wherein the liquid solution is ozone rich.

5. (Original) The apparatus of Claim 1, wherein the sprayer comprises a plurality of spray nozzles.

6. (Currently Amended) The apparatus of Claim 1, wherein the pulsating fluid liquid source is configured to pulse at approximately one pulse every two seconds.

7. (Currently Amended) The apparatus of Claim 1, wherein the pulsating fluid liquid source has a 50% duty cycle.

8. (Cancelled)

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9. (Previously Presented) The apparatus of Claim 1, wherein the wafer is located between the sprayer and the rotator.

10. (Currently Amended) An apparatus for processing a wafer, the apparatus comprising:

a semiconductor processing chamber;
a rotator configured to rotate at least one wafer within the semiconductor processing chamber; and

a pulsating fluid liquid source, the pulsating fluid liquid source configured to pulse an ozone-rich liquid solution into the semiconductor processing chamber more than once while the wafer is rotating within the semiconductor processing chamber, the pulsating liquid source having a duty cycle that varies between 3% and 97%.

11. (Original) The apparatus of Claim 10, wherein the rotator comprises at least one rod that contacts an outside edge of the wafer.

12. (Original) The apparatus of Claim 11, wherein the at least one rod supports the wafer.

13. (Original) The apparatus of Claim 10, wherein the semiconductor processing chamber is rotated by the rotator.

14. (Currently Amended) The apparatus of Claim 10, wherein the pulsating fluid liquid source further comprises a pump configured to pulse the ozone-rich liquid solution.

15. (Original) The apparatus of Claim 14, wherein the rotator is further configured to rotate the wafer at more than one speed.

16. (Currently Amended) The apparatus of Claim 10, wherein the temperature of the liquid solution is between approximately 20°C and approximately 95°C.

17. (Currently Amended) An apparatus comprising:

a rotating platform configured to rotate a workpiece-semiconductor wafer;
and

a pulsator configured to introduce multiple pulses of an ozone-rich liquid solution onto the workpiece wafer while the workpiece wafer is rotating, the pulsator being further configured to pulse the liquid solution at a duty cycle that varies between 3% and 97%.

18. (Cancelled)

19. (Currently Amended) The apparatus of Claim 17, wherein the workpiece wafer is rotated at a speed less than approximately 100 rotations per minute (RPM).

20. (Original) The apparatus of Claim 17, wherein the pulsator has a 50% duty cycle.

21. (Original) The apparatus of Claim 17 wherein the pulsator has an 8% duty cycle.

22. (Original) The apparatus of Claim 17, wherein the pulsator comprises a pump.

23. (Currently Amended) An ozone shower system for cleaning a semiconductor wafer, the system comprising:

a process chamber configured to house a wafer;

a rotator within the process chamber, wherein said rotator is configured to rotate the wafer; and

a sprayer connected to an ozone-enriched fluid liquid source, wherein the sprayer is configured to pulse the ozone-enriched fluid liquid multiple times on the wafer at a duty cycle that varies between 3% and 97% during the rotation of the wafer.

24. (Original) The ozone shower system of Claim 23, wherein the rotator comprises at least one axle.

25. (Original) The ozone shower system of Claim 24, wherein the at least one axle contacts the outside edge of the wafer.

26. (Original) The ozone shower system of Claim 24, wherein the rotator comprises two axles.

27. (Original) The ozone shower system of Claim 23, wherein the sprayer comprises a plurality of spray nozzles.

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28. (Currently Amended) The ozone shower system of Claim 23, wherein the ozone fluid liquid is at a temperature between approximately 20° and approximately 95°C.

29. (Original) The ozone shower system of Claim 23, wherein the wafer is positioned between the rotator and the sprayer.

30. (Currently Amended) The ozone shower system of Claim 23, wherein the rotation of the wafer is caused in part by the pulsating ozone-enriched fluid liquid.

31. (Currently Amended) An apparatus for delivering ozone to multiple wafers, the apparatus comprising:

a means for rotating multiple wafers within a semiconductor processing chamber; and

a means for pulsating an ozone-rich liquid solution multiple times onto the multiple wafers at a duty cycle that varies between 3% and 97% while the multiple wafers are being rotated.

32. (Original) The apparatus of Claim 31, wherein the means for rotating comprises at least one rod.

33. (Original) The apparatus of Claim 31, wherein the means for pulsating comprises a pump.

34. (Original) The apparatus of Claim 31, wherein the multiple wafers are located between the means for rotating and the means for pulsating.

35. (Original) The apparatus of Claim 31, wherein the semiconductor processing chamber comprises a wafer cassette.

36. (Original) The apparatus of Claim 31, wherein the means for rotating creates a gap between the multiple wafers and the wafer cassette.

37. (Original) The apparatus of Claim 31, wherein the semiconductor processing chamber remains stationary while the multiple wafers are being rotated.

38. (Original) The apparatus of Claim 31, wherein the means for rotating is configured to rotate the multiple wafers at multiple speeds.